Simplified Protein Production Method Brings New Hopes For Future Medical Applications

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Did you ever stop to think that almost every metabolic process your body does is controlled by molecules smaller than a grain of sand? These particles are known as proteins, and they are one of the four classes of macromolecules that have the capability to do tremendous wonder for the body (for example, build biological structures such as muscles and neurons). In addition, proteins digest food for energy, regulate biological functioning (for example, by blood cells), provide cell to cell communication, work as enzymes, and provide structure for the cell. The list goes on and on, leading one to realize that proteins are an important part of our life. It is therefore important to realize that these proteins do not grow on trees, but are actually synthesized in a complex, ongoing process that occurs every moment of our lives. (Gorga, "Introduction to Protein Structure")

Over the last couple of decades, significant research has been conducted regarding the ways one can extract individual proteins and use them to study the protein's molecular structure and function, thus providing data which scientists can then use to develop ways to replicate the proteins to use for medical and biological purposes. One of the methods that many scientists have been using to investigate protein synthesis is the T7 gene expression system, which was developed and patented at Brookhaven Lab in the 1980s and 1990s. This system is used worldwide by scientists and industry to produce specific proteins within bacterial cells, which once again allows the scientists to study individual proteins within these bacterial cells. (Studier, 2004)

Recently, however, Brookhaven Lab Biophysicist F. William Studier developed a new

process that simplifies the production of proteins in the T7 gene expression system. This system, which is now commercially available, is known as the Overnight Express Autoinduction System, won Studier that Brookhaven R&D 100 Award in 2004. This new system depends on mechanisms by which bacteria sense the presence of nutrients in their surroundings and select which ones to use. Studier discovered an appropriate mixture of nutrients that allows the bacteria to grow rapidly and then eventually switch automatically to producing the target protein without any support from the experimenter. (Carter, "Protein Production")

Studier's study was based primarily on the proven theory that recombinant DNA plasmids can be used to produce a specific protein. Basically, recombinant DNA plasmids can be inserted into bacteria which produce millions of copies of the specific genetic sequence of interest. Then, enzymes and chemicals that cause the bacteria to overexpress the protein encoded by the recombinant plasmid are introduced into the solution containing the bacteria. At the end of the process, there are millions of bacteria that contain a sufficient amount of the protein being studied. This is mostly what Studier used in his research, and he was able to test the different responses of the bacteria to the new inserted protein which eventually helped him find the most efficient way for the protein to be produced in a large quantity. (Carter, "Protein Production")

Studier's new method has many potential uses for the future, especially in biomedical research. In addition, his new method can be used for industrial production of proteins to use as enzymes, diagnostics, vaccines, therapeutics, and targets for developing pharmaceuticals. Hopefully, his research will even help other scientists find possible methods of disease prevention. By studying specific proteins, it is not improbable that we will find an even better method to synthesize specific proteins in the near future (like hemoglobin in red blood cells) that

can be used to further advance our body's ability to function and enhance the cell's performance. (Studier, 2004)

Bibliography

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